

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s)	Seppo Nissilä	Examiner:	Patricia C. Malari
Serial No.:	10/735,255	Group Art Unit:	3736
Filed:	April 16, 2003	Docket:	187-73
For:	CODING HEART RATE INFORMATION	Dated:	October 31, 2005

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

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*on October 31, 2005*

Signed: *Joyce Peterson*

DECLARATION UNDER 37 CFR 1.132

I, Ilkka Tapani Heikkilä, declare and state the following:

1. I am currently employed as VYLE PRESIDENT, R&D (insert title) by Polar Electro Oy, Kempele, Finland, the assignee of the above-identified application.

2. I am an expert in the field of electronics and have worked in the electronics field for 27 (insert number of years) years.

3. I received a Masters of Science degree in electronics from UNIVERSITY OF DUBLIN (insert university) in 1984 (insert year).

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4. I have reviewed the Office Action mailed June 30, 2005, and the above-identified patent application, including the pending claims, as currently amended. This declaration is being submitted to establish that the above-identified application would have enabled one skilled in the art at the time of filing to make and use the claimed invention without undue experimentation.

5. Claims 1 and 10, as currently amended recite that a person's heart beat intervals are measured during a physical exercise and that the result of this measurement is stored as heart beat interval information. One skilled in the art would know that if the stored heart beat interval information were played back, its duration would correspond to the duration of the physical exercise. One skilled in the art would also know that if a portion of the stored heart beat interval information were removed and the remaining heart beat interval information were played back, its duration would be less than the duration of the physical exercise.

6. Pages 20-22 of a publication entitled "Principles of Operation A Practical Primer" by R. Lee Gordon, dated January 8, 1996, submitted as Exhibit B, discloses averaging as a known technique to reduce the time required for data transmission, which is analogous to playback duration. Specifically, page 20 of the publication describes an averaging technique as dividing a total of 20,000 pings or data points into 200 ensembles of 100 pings each. The publication states that although data transmission takes time and can slow down ping processing, averaging reduces the time required for data transmission at page 22.

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7. Claims 1 and 10 further recite that the heart beat interval information is packed, which, as disclosed in paragraph 0014 of the specification, may be performed by averaging, "whereby the heart beat interval data of a given time interval is represented by the mean heart rate of said time". Therefore, one skilled in the art would know that packing the heart beat interval information could be performed by taking an average of "given time intervals" (such as 10-second intervals) of the heart rate interval information (such as for a 60-minute physical exercise) to yield packed heart beat interval information (or 360 average values), which is substantially the same technique as that disclosed in the publication referred to in paragraph 6 above.

8. Paragraph 0033 of the application states that the "packing ratio can be tenfold or hundredfold". Thus, since heart rate is typically calculated from heart beat interval information every second, one skilled in the art would understand that when averaging is performed on, for example, every 10 seconds of heart rate interval information, the resulting quantity of data is reduced by a factor of ten.

9. Claims 1 and 10 still further recite that at least a portion of the packed heart beat interval information is coded into a sound collage, and that the duration of the sound collage is shorter than the time spent for measuring the heart beat intervals. Reducing the amount of data to playback reduces the duration of playback, as established in paragraphs 5 and 6 above. The packed heart rate interval information represents a reduction in the amount of heart beat interval information originally measured, as established in paragraph 8 above. Therefore, one skilled in the art would know that coding at least a portion of the packed heart

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beat interval information would result in a sound collage that is shorter in duration when played back than the time spent for measuring the heart beat intervals.

10. An invention report prepared by the inventor on June 3, 2003, entitled ""KEKSINTÖILMOITUS" is submitted as Exhibit A. An English translation of page1, paragraph 3, starting from "Mrittele ongelman ratkaisu" and ending at "60 sek" is as follows:

Define the solution to the problem

A heart rate file is converted to a sound collage based on the heart beat of the heart rate file. By using a rhythm generator and adding other sounds, the heart rate file can be coded and presented. The heart rate file is also packed by averaging and/or resampling to give a file having a shorter duration in time, for example 60 min -> 60 sec.

It is submitted that Exhibit A, being a communication from the inventor to a committee that assesses the merits of the invention, indicates that the inventor was in possession of the claimed invention prior to the filing date of the subject application and that the concepts disclosed therein, including packing by averaging to yield a file shorter in duration than the original file, were successfully communicated from one skilled in the art, the inventor, to the committee and the attorney preparing the application.

11. Thus, the application would have enabled one skilled in the art to make and use the claimed invention at the time of filing without undue experimentation.

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12. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Respectfully submitted,



Ilkka Tapani Heikkilä

Date: October 31, 2005

Tarha

T299026

Äänisänto Kisti



Työsuhtekeksinnöt  
Työohje

Polar #3

26.6.2002 → KILSTER

AI0090F  
sivu 1 (3)

rauhkeuseen

+ US-patentti Dohor perustetaan suuttan

## KEKSINTÖILMOITUS

- ei ole mitään materiaalia

Toimitetaan kahtena kappaleena työsuhtekeksintötoimikunnalle, joka palauttaa yhden kappaleen keksijälle vastaanottomerkinnöillä varustettuna. Piirustusten on oltava A4-kokoa.

Vastaanotettu 31.6.2002 Ilmoitus nro KI 0204  
Käsitelty työsuhtekeksintötoimikunnassa 31.6.2002

Keksijöiden nimet ja kotiosoitteet  
Seppo Nissilä, Sääskitie 4, 90550 Oulu

Keksinnön nimitys  
Data to sound

Lyhyt selvitys keksinnöstä (tarpeen vaatiessa käytettävä liitettä)

- Määrittele ongelma tai idea

Talletettujen syketiedostojen purkaminen ja tarkastelu on hidasta ja työlästä, kun tiedostot ovat pitkiä. Toisaalta harjoitustiedostojen esittäminen ja kuvailu on vaikeaa.

- Määrittele ongelman ratkaisu

Syketiedosto muutetaan äänikoosteeksi, jonka pohjana on syketiedoston syketähti. Käyttämällä rytmigeneraattoria sekä lisäämällä muita ääniä harjoituksen syketiedosto saadaan purettua ja esitettyä. Syketiedosto myös pakataan keskiarvoistamalla ja/tai uudelleen näytteistämällä ajallisesti lyhyemmäksi, esimerkiksi 60 min -> 60 sek.

- Määrittele keksinnön hyödyt

Harjoitustiedosto voidaan esittää uudella mielenkiintoisella tavalla. Toisaalta se kuvaa ääniefektein harjoituksen kulkua. Äänitoteutus voidaan tehdä sekä kellolaitteessa pietsolla, mutta PC- ympäristö mahdollistaa laajemman äänimaailman käytön.

- Keksinnön toteutustapa

Koodataan ohjelma, joka muodostaa annetun tahdin (keskiarvo syke) pohjalta rytmin ja lisää siihen ääniefektejä sykkeen muutosten ja keston perusteella. Äänen soittamisessa käytetään kellon pietsoa tai PC:n äänikorttia. Äänestä voi tallentaa oman tiedoston, jonka voi tallettaa ja siirtää eri muodoissa (esim MP3) eri laitteille ja kaverille myös.

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Polar Electro Oy saattaa työsuhdekeksintöjä koskevan lain perusteella olla oikeutettu saamaan keksintöön liittyvät oikeudet kokonaan tai osittain itselleen.

Ilmoitan/Ilmoitamme täten, että tietääkseni/tietääksemme olen/olemme ainoa(t) keksijä(t).

**Tekemäni/tekemämme keksinnön katson/katsomme kuuluvan ryhmään A**  
(kts. liite, kohta 1)

Sitoudun/sitoudumme allekirjoittamaan kaikki asiakirjat, jotka tarvitaan keksinnön suojaamiseen eri maissa.


Keksintö tulee julkiseksi mahdollisesti jo  
(kts. liite, kohta 2) / 20

Suostun/suostumme siihen, että työsuhdekeksintöjä koskevan pysyvääsmääräyksen mukaista työnantajan vastausaikaa tähän ilmoitukseen voidaan pidentää (kts. liitteen kohta 3)

☐ Kyllä ☒ Ei

Keksijän/keksijöiden allekirjoitus

\_\_3\_\_ / \_\_6\_\_ 2002\_\_



## 7. Ensemble Averaging

Single-ping velocity errors are too large to meet most measurement requirements. Therefore, data are averaged to reduce the measurement uncertainty to acceptable levels. This section defines ADCP uncertainties, averaging methods, and the effect of averaging on data uncertainty.

### ADCP Errors and Uncertainty Defined

Velocity uncertainty includes two kinds of error — random error and bias. Averaging reduces random error but not bias.

Figure 19 shows these errors with two example distributions of ADCP current estimates. Assume that the distribution in Figure 19A was computed from 20,000 measurements of exactly the same current. In this distribution, the measurements cluster around the actual value of the current, but there is variation due to the random error. Note also that the overall average is different from the actual current. Bias causes this difference.

Because random error is uncorrelated from ping to ping, averaging reduces the standard deviation of the velocity error by the square root of the number of pings, or:

$$\text{Standard Deviation} \propto N^{-1/2} \quad (5)$$

where N is the number of pings averaged together.

The distribution in Figure 19B shows what might happen if we were to make 200 ensembles of 100 pings each from the original 20,000 pings. Averaging the 100 pings in each ensemble reduces the random error of each ensemble by a factor of about 1/10. This is clear in the smaller spread of the lower distribution. Note that the average value of both distributions are the same and that both are different from the actual current. This difference, that does not go away with averaging, is the measurement bias.

An important point is that averaging can reduce the relatively large random error present in single-ping data, but that, after a certain amount of averaging, the random error becomes smaller than the bias. At this point, further averaging will do little to reduce the overall error.

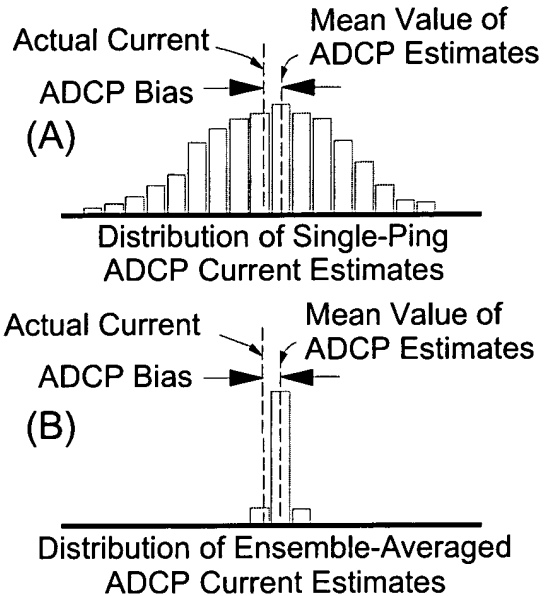


Figure 19. The distribution of single-ping data (A) compared with the distribution of 200-ping averages of the same data (B).



### **Short- Vs. Long-Term Uncertainty**

Short-term uncertainty is defined as the error in single-ping ADCP data. Short-term uncertainty is dominated by random error.

Long-term uncertainty is defined as the error present after enough averaging has been done to essentially eliminate random error. Long-term error is the same as bias.

### **The Approximate Size of Random Error and Bias**

ADCP single-ping random error or short-term error can range from a few mm/s to as much as 0.5 m/s. The size of this error depends on internal factors such as ADCP frequency, depth cell size, number of pings averaged together and beam geometry. External factors include turbulence, internal waves and ADCP motion.

Random error in narrowband ADCPs is relatively easy to estimate, but it is harder to estimate for BroadBand ADCPs. This is because BroadBand measurements have more adjustable parameters, each of which affects uncertainty. Because random errors generated internally in the ADCP are typically an order of magnitude smaller than in a comparable narrowband ADCP, external random error sources (i.e. turbulence) can dominate internal ADCP errors.

You can estimate random errors by computing the standard deviation of the error velocity. This is because random errors are independent from beam to beam and because the error velocity is scaled by the ADCP to give the correct magnitude of horizontal-velocity random errors. To predict the size of internal random errors, consult brochure specifications or use one of the various software tools that RDI provides for this purpose.

Bias is typically less than 10 mm/s. This bias depends on several factors including temperature, mean current speed, signal/noise ratio, beam geometry, etc. It is not yet possible to measure ADCP bias and to calibrate or remove it in post-processing.

### **Beam Pointing Errors**

Beam pointing errors can be a dominant source of velocity bias. A beam pointing error is uncertainty in the beam direction. Standard manufacturing practice introduces errors into beam angles. Depending on measurement requirements and the care with which the transducer elements were installed, these errors could introduce unacceptable bias. The as-installed beam angles are measured in the manufacturing process and stored in the BroadBand ADCP's memory. These angles modify the coordinate conversion matrix which corrects for beam pointing errors when converting from beam to earth velocity coordinates.

### **Averaging Inside the ADCP Vs. Averaging Later**

An ADCP system can calculate ensemble averages inside the ADCP, in the data acquisition system, or in both. It is possible, for example, to average ensembles of several pings in the ADCP and to send the results to a computer which then computes averages of these ensembles. Normally, unless there is a good reason to do otherwise, the best rule is to let the ADCP convert data into earth coordinates and

to average data into ensembles before transmitting them out. Following is a list of the factors that might affect your choice of where to average your data.

- Vector averaging — Conversion to earth coordinates prior to averaging allows the ADCP to compute true vector averages.
- Beam pointing errors are automatically corrected when the ADCP converts from beam to earth coordinates, thus minimizing related biases.
- Data transmission takes time and can slow down ping processing. Averaging reduces the time required for data transmission.

### The Processing Cycle: Limitations on Averaging

Averaging is limited by the ping rate, which is limited by how fast the ADCP can collect, process and transmit data. Figure 20 shows a typical data collection cycle inside the ADCP. Each ping has five phases: overhead, transmit pulse, blank period, processing, and sleep. The overhead time is used to wake up the ADCP, initialize and process various subsystems (e.g. the clock, compass, etc.) and to prepare for ping processing. After pulse transmission and a short delay to allow the transducer to ring down (see later), the ADCP begins to process the echo. When echo processing is complete, the ADCP either goes to sleep to conserve battery power or immediately begins another data collection cycle. After all the pings are collected, the ADCP computes an ensemble average and transmits the data to the internal data recorder, to an external data acquisition system, or to both. When the ADCP pings rapidly, data transmission runs in the background, using CPU time when it is free.

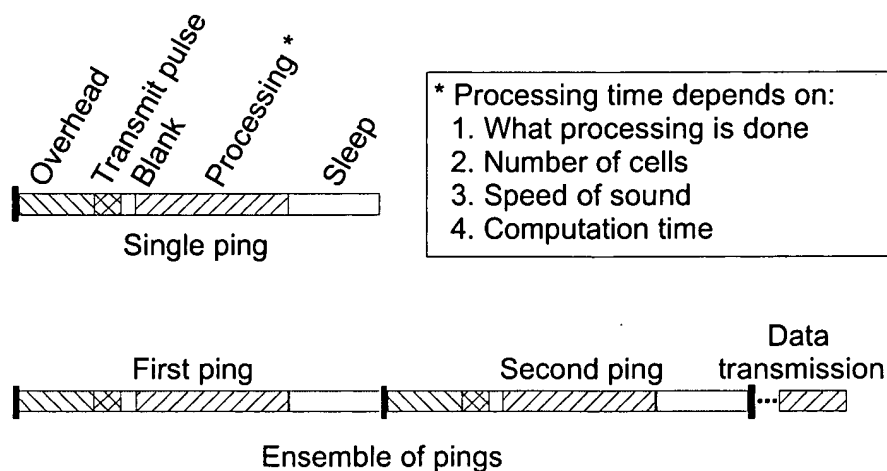


Figure 20. Steps in the ping processing cycle